## Session 10 – Wednesday 13th March 2013

# Introduction to Financial Modelling for DSM


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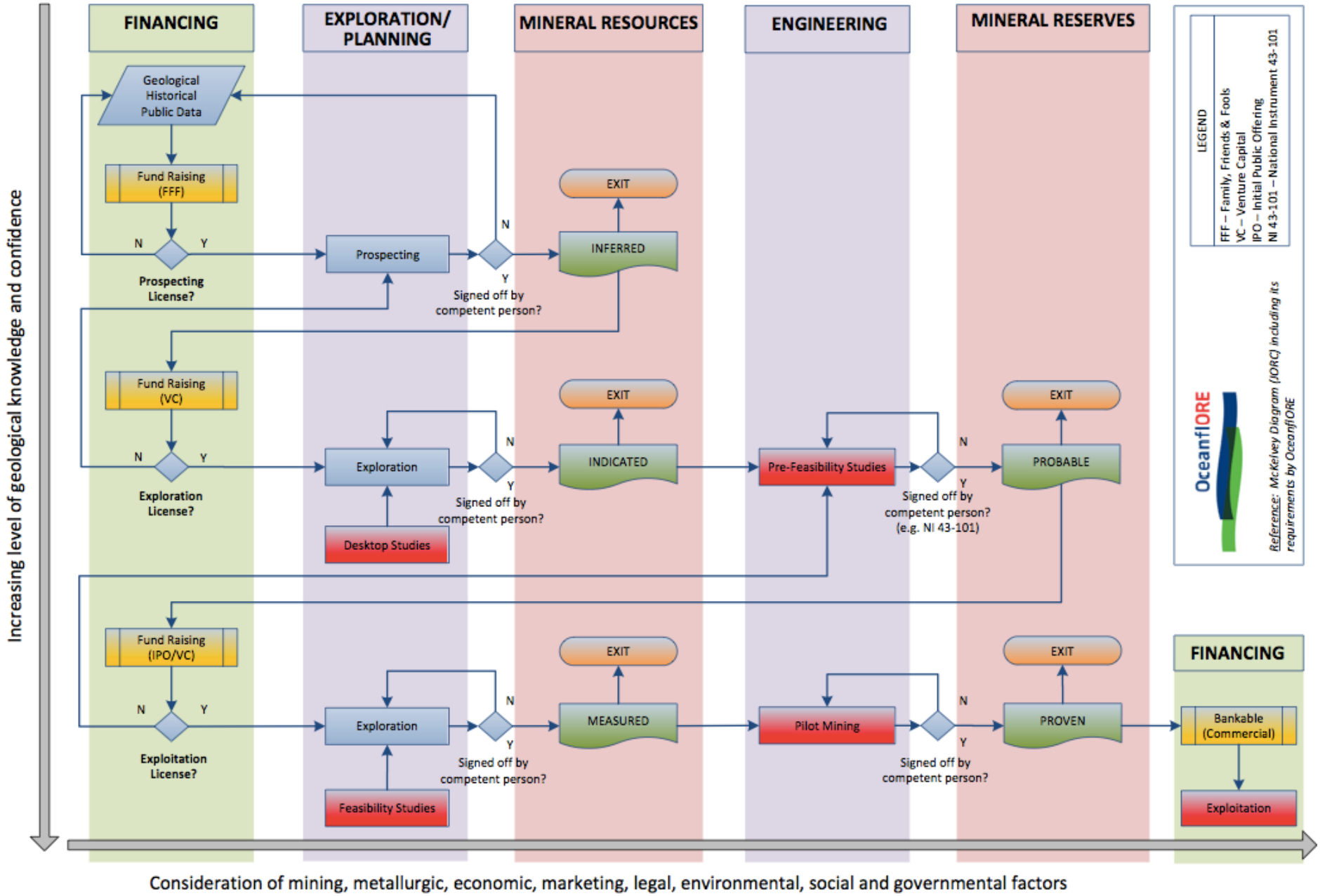
# Session 10 – Outline Agenda

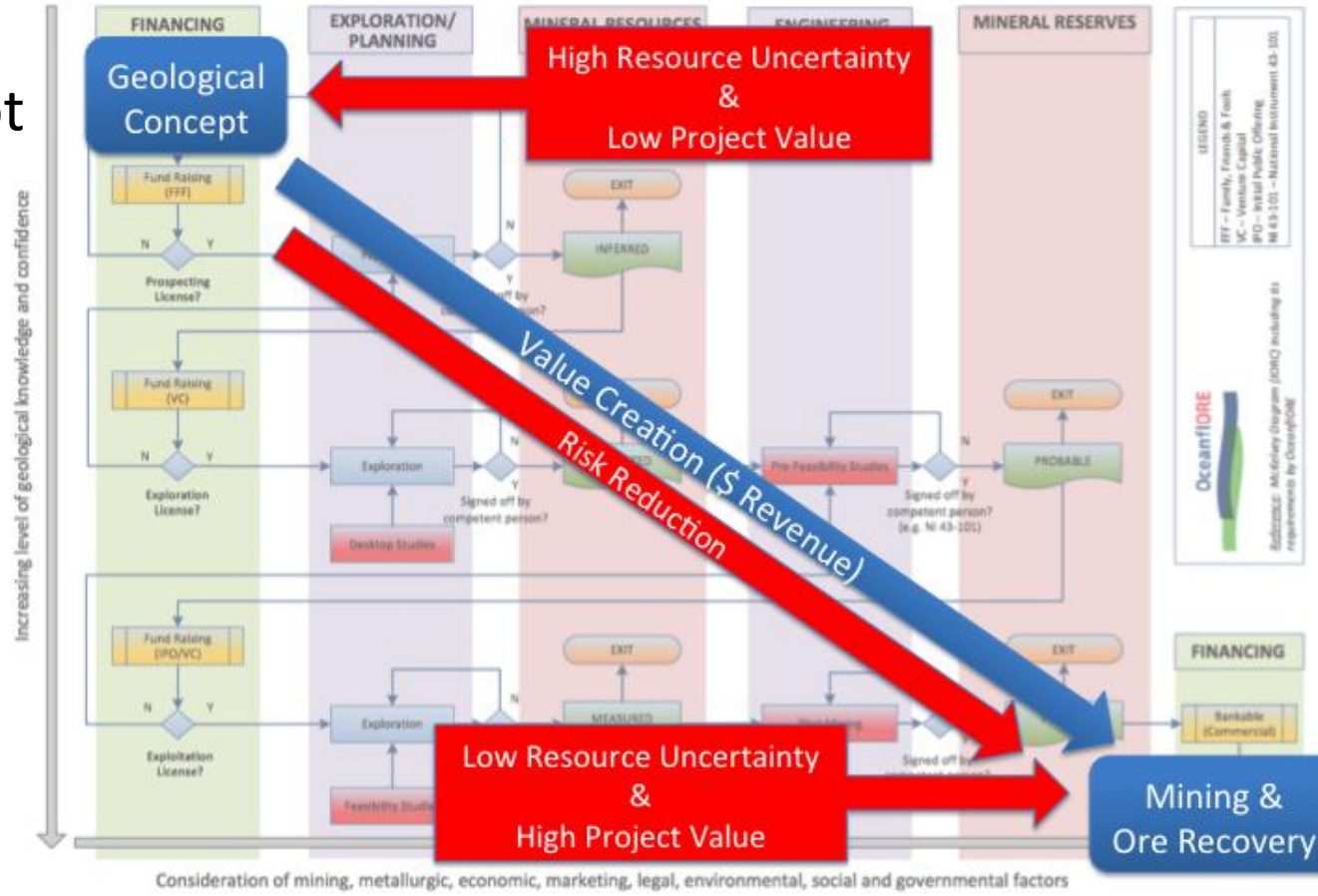
## Introduction to Financial Modelling for DSM

- Recall: The Pre-Mining Valuation Dilemma
  The Concept of EMV
- Step 1 = Defining NPV inputs & calculations
  Quantifying Uncertainty using Data Ranges
- Mining Market Fundamentals
  DSM Market Potential
  Onshore Mining Cost Fundamentals
- Conclusions


FINANCING
EXPLORATION/ PLANNING
MINERAL RESOURCES
ENGINEERING
MINERAL RESERVES
Increasing level of geological knowledge and confidence
Geological Historical Public Data
Fund Raising (FFF)
N
Y
Prospecting License?
Prospecting
N
Y
Signed off by competent person?
EXIT
INFERRED
Fund Raising (VC)
N
Y
Exploration License?
Exploration
N
Y
Signed off by competent person?
EXIT
INDICATED
Desktop Studies
Pre-Feasibility Studies
N
Y
Signed off by competent person? (e.g. NI 43-101)
EXIT
PROBABLE
Fund Raising (IPO/VC)
N
Y
Exploitation License?
Exploration
N
Y
Signed off by competent person?
EXIT
MEASURED
Feasibility Studies
Pilot Mining
N
Y
Signed off by competent person?
EXIT
PROVEN
FINANCING
Bankable (Commercial)
Exploitation
LEGEND
FFF – Family, Friends & Fools
VC – Venture Capital
IPO – Initial Public Offering
NI 43-101 – National Instrument 43-101
OceanfIORE
Reference: McKelvey Diagram (JORC) including its requirements by OceanfIORE
Consideration of mining, metallurgic, economic, marketing, legal, environmental, social and governmental factors

# The Pre-Mining Valuation Dilemma

**EMV$**
@ concept

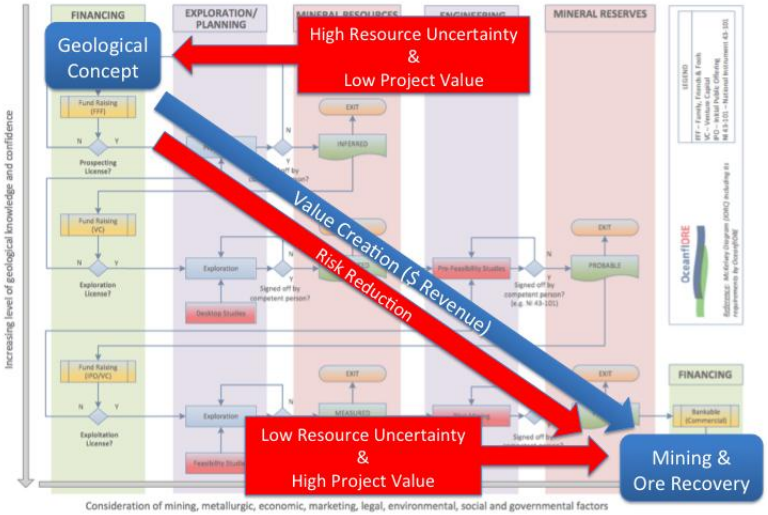



**NPV$**
@ mining

# An Example of EMV

- The EMV$ value during the Pre-Mining stage of a project is a fraction (PoS%) of the potential project value (NPV$).
- Step 1 = Calculate the success case NPV$ *(analytical specialist)*
- Step 2 = Clearly state the inputs to estimate PoS%

**EMV = $10**
@ concept
If PoS = 10%




**NPV = $100**
@ start of mining

# Revenue Inputs to NPV Calculation

Positive inputs include:

- Total resource tonnage
- Economic cut-off grades
- Average head grade
- Annual production volumes
- Metal and commodity price forecasts
- Exchange rates on contracts
- Mineral supply and demand volume forecasts

# Cost Inputs to NPV Calculation

Negative inputs include:

- Mining method, mining dilution and recovery factors
- Metallurgical process, testwork and recovery factors
- Capital and mining operating cost assumptions
- Ore transportation and treatment charges
- Royalties, Government corporate taxes
- Licencing charges
- Community Development Agreement costs
- Environmental studies and monitoring
- Rehabilitation and abandonment costs

# Single Point NPV Outcome

**PROJECT CASH FLOW**

| | | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ore Production | ('000 t) | | | - | - | - | 500 | 1,350 | 1,350 | 1,350 | 1,350 | 1,350 | 1,350 | 1,350 | 1,350 | 1,200 | - |
| **Real Cash Flows** | | | | | | | | | | | | | | | | | |
| Revenue | ($ Mill.) | | | - | - | - | 376.1 | | | | | | | | | | |
| Royalty | ($ Mill.) | | | - | - | - | 8.8 | | | | | | | | | | |
| Net Revenue | ($ Mill.) | | | - | - | - | 367.3 | | | | | | | | | | |
| Direct Operating Costs | | | | | | | | | | | | | | | | | |
| Mining | ($ Mill.) | | | - | - | - | 40.0 | | | | | | | | | | |
| Transport to Concentrator | ($ Mill.) | | | - | - | - | 10.0 | | | | | | | | | | |
| Processing | ($ Mill.) | | | - | - | - | 10.0 | | | | | | | | | | |
| Administration | ($ Mill.) | | | - | - | - | 10.0 | | | | | | | | | | |
| Sub-Total Mine & Process | ($ Mill.) | | | - | - | - | 70.0 | | | | | | | | | | |
| Transport to Smelter | ($ Mill.) | | | - | - | - | 2.7 | | | | | | | | | | |
| Copper SmelterTreatment | ($ Mill.) | | | - | - | - | 12.7 | | | | | | | | | | |
| Zinc Smelter Treatment | ($ Mill.) | | | - | - | - | 10.28 | | | | | | | | | | |
| Sub-Total Smelter | | | | - | - | - | 25.6 | | | | | | | | | | |
| Total Direct Operating Costs | ($ Mill.) | | | - | - | - | 95.6 | | | | | | | | | | |
| Fixed Operating Costs | | | | | | | | | | | | | | | | | |
| Administration | ($ Mill.) | | | - | 2.0 | 2.0 | 2.0 | | | | | | | | | | |
| Total Operating Cost | ($ Mill.) | | | - | 2.0 | 2.0 | 97.6 | | | | | | | | | | |
| Net Operating Cash Flow | ($ Mill.) | | | - | 2.0 | - 2.0 | 269.7 | | | | | | | | | | |
| Capital Expenditure | | | | | | | | | | | | | | | | | |
| Before Tax Cash FLow | ($ Mill.) | | | - | 64.8 | 216.0 | 109.2 | 9.8 | 19.8 | 19.8 | 64.8 | 64.8 | 19.8 | 19.8 | 19.8 | - | - |
| | | | | - | 66.8 | - 218.0 | 160.5 | 721.9 | 711.9 | 711.9 | 666.9 | 666.9 | 711.9 | 711.9 | 711.9 | 650.1 | - |
| Income Tax (Real) | ($ Mill.) | | | - | 0.6 | - 0.6 | 73.7 | 205.4 | 202.9 | 200.3 | 200.6 | 203.6 | 201.2 | 201.5 | 201.8 | 177.6 | - |
| After Tax Cash Flow | ($ Mill.) | | | - | 66.2 | - 217.4 | 86.8 | 516.5 | 509.0 | 511.6 | 466.2 | 463.3 | 510.7 | 510.4 | 510.1 | 472.5 | - |
| **Actual Cash Flows** | | | | | | | | | | | | | | | | | |
| Escalation Multiplier | ($ Mill.) | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 |
| Net Revenue | ($ Mill.) | | | - | - | - | 426.0 | 1,178.9 | 1,208.4 | 1,238.6 | 1,269.6 | 1,301.3 | 1,333.9 | 1,367.2 | 1,401.4 | 1,276.8 | - |
| Operating Costs | ($ Mill.) | | | - | - | - | 110.9 | 306.9 | 314.6 | 322.4 | 330.5 | 338.8 | 347.2 | 355.9 | 364.8 | 332.4 | - |
| Fixed Operating Costs | ($ Mill.) | | | | 2.2 | 2.3 | 2.3 | 2.4 | 2.4 | 2.5 | 2.6 | 2.6 | 2.7 | 2.8 | 2.8 | 2.9 | - |
| Net Operating Cash Flow | ($ Mill.) | | | - | 2.2 | - 2.3 | 312.8 | 869.7 | 891.4 | 913.7 | 936.5 | 959.9 | 983.9 | 1,008.5 | 1,033.8 | 941.5 | - |
| Depreciation & Amortisation | ($ Mill.) | | | - | - | - | 27.9 | 55.8 | 67.4 | 79.9 | 80.5 | 69.5 | 81.9 | 82.6 | 83.3 | 83.9 | - |
| Taxable Cash Flow | ($ Mill.) | | | - | 2.2 | - 2.3 | 284.9 | 813.9 | 824.0 | 833.8 | 856.1 | 890.4 | 902.0 | 926.0 | 950.5 | 857.6 | - |
| Income Tax | ($ Mill.) | | | - | 0.7 | - 0.7 | 85.5 | 244.2 | 247.2 | 250.1 | 256.8 | 267.1 | 270.6 | 277.8 | 285.2 | 257.3 | - |
| After Tax Operating Cash Flow | ($ Mill.) | | | - | 1.5 | - 1.6 | 227.3 | 625.5 | 644.2 | 663.5 | 679.7 | 692.8 | 713.3 | 730.8 | 748.6 | 684.3 | - |
| Capital Expenditure | ($ Mill.) | | | - | 71.5 | 244.4 | 126.6 | 11.6 | 24.1 | 24.7 | 82.9 | 85.0 | 26.6 | 27.2 | 27.9 | - | - |
| After Tax Cash Flow | ($ Mill.) | | | - | 73.1 | - 246.0 | 100.7 | 613.9 | 620.1 | 638.9 | 596.8 | 607.9 | 686.8 | 703.5 | 720.7 | 684.3 | - |

| | |
|---|---|
| Net Present Value (Real) (1 Jan 2013) | (USD) |
| NPV(10) | ($ Mill) |
| Internal Rate of Return (Real) | (%) |
| Copper Production (Avg. Annual) | ('000 tpa) |
| Average Annual Revenue (Real) | ($ Mill pa) |
| Revenue per tonne of Resource (Real) | ($/t) |
| Cash Op Cost per tonne of Resource (Real) | ($/t) |
| Initial Capital Cost (Real) | ($ Mill) |

# Quantifying Uncertainty = a Range of Outcomes

- A single NPV$ outcome infers that we have (near) perfect knowledge of the project value = wrong [GIGO Principle]
- Manage and quantify uncertainty by embracing ranges of inputs and outputs, put simply:

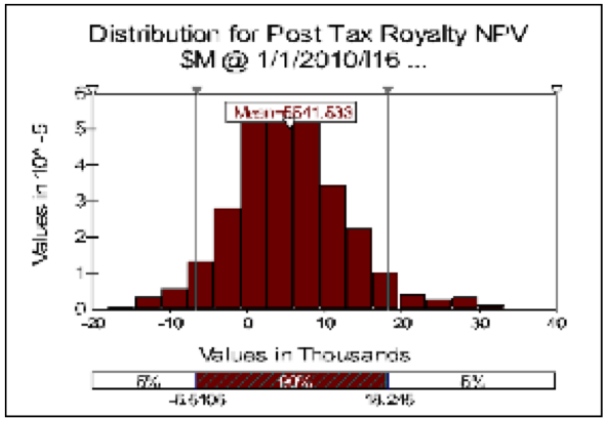
| INPUT | Low | Most Likely | High |
|---|---|---|---|
| Costs | - | - | - |
| Revenues | + | + | + |
| **OUTPUT** | | | |
| NPV$ | $ | $ | $ |
| PoS% * | % | % | % |
| EMV$ | $ | $ | $ |

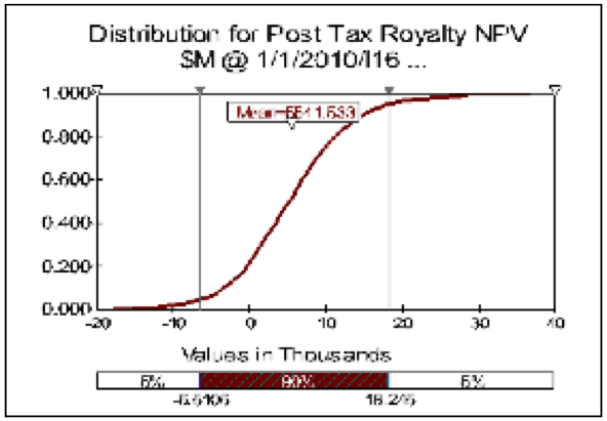
** Input to EMV$*

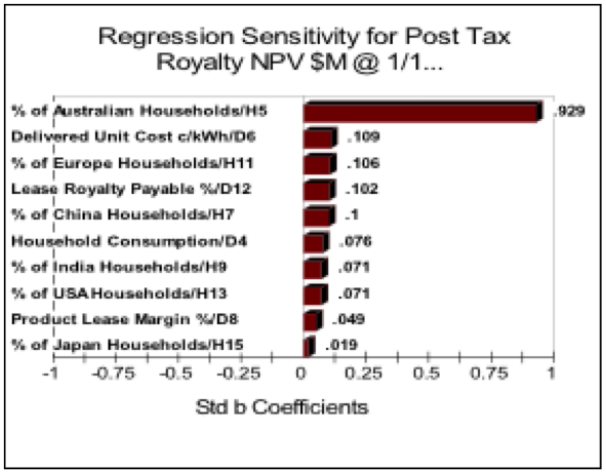
# Pre-Mining Project Value as a Range

| Summary Information | |
|---|---|
| Workbook Name | 0 yr Royalty NPV @Risk |
| Number of Simulations | 10 |
| Number of Iterations | 1000 |
| Number of Inputs | 11 |
| Number of Outputs | 1 |
| Sampling Type | Monte Carlo |
| Simulation Start Time | 12/08/09 11:39 |
| Simulation Stop Time | 12/08/09 11:39 |
| Simulation Duration | 00:00:34 |
| Random Seed | 894204180 |

| Summary Statistics | | | |
|---|---|---|---|
| Statistic | Value | %tile | Value |
| Minimum | -$17,838.77 | 5% | -$6,510.58 |
| Maximum | $36,811.22 | 10% | -$3,537.06 |
| Mean | $5,541.53 | 15% | -$1,632.55 |
| Std Dev | $7,609.13 | 20% | -$426.59 |
| Variance | 57898784.67 | 25% | $590.79 |
| Skewness | 0.425691442 | 30% | $1,550.52 |
| Kurtosis | 3.948861828 | 35% | $2,381.57 |
| Median | $5,223.39 | 40% | $3,440.85 |
| Mode | $13,124.34 | 45% | $4,231.61 |
| Left X | -$6,510.58 | 50% | $5,223.39 |
| Left P | 5% | 55% | $6,013.27 |
| Right X | $18,245.01 | 60% | $6,843.29 |
| Right P | 95% | 65% | $7,822.64 |
| Diff X | $24,755.59 | 70% | $8,736.33 |
| Diff P | 90% | 75% | $9,834.07 |
| #Errors | 0 | 80% | $11,088.05 |
| Filter Min | | 85% | $12,850.31 |
| Filter Max | | 90% | $14,903.31 |
| #Filtered | 0 | 95% | $18,245.01 |



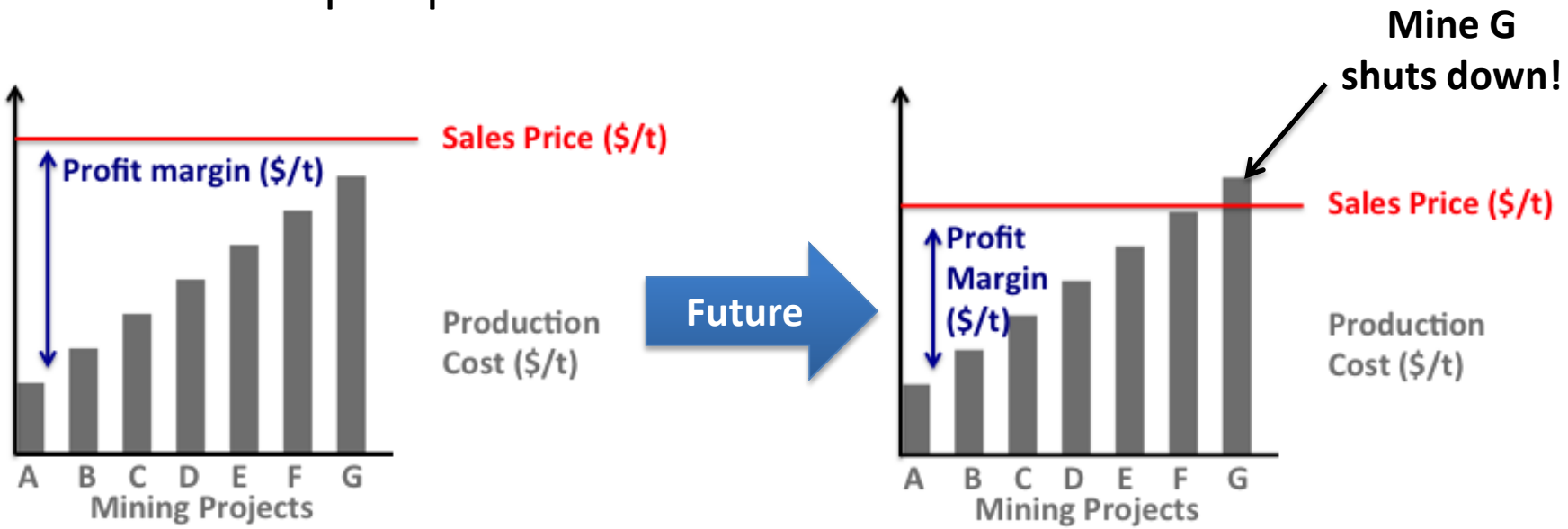

- Encourage data ranges
- Quantify uncertainty
- Increase confidence in DSM project values

# Mining Market Fundamentals

Mining Financials 1.01:

- "Survival of the fittest" = lowest cost miner wins biggest profit!

  … and prospers in hard times.

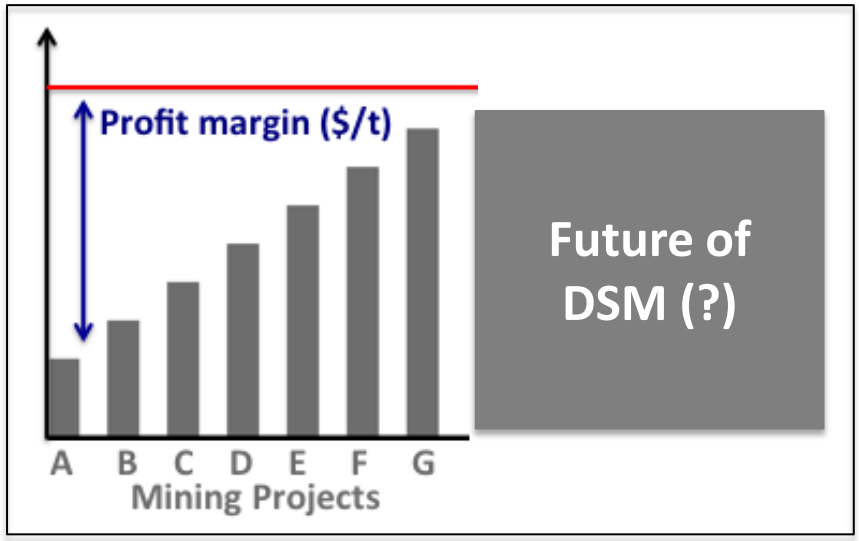


# DSM Market Potential

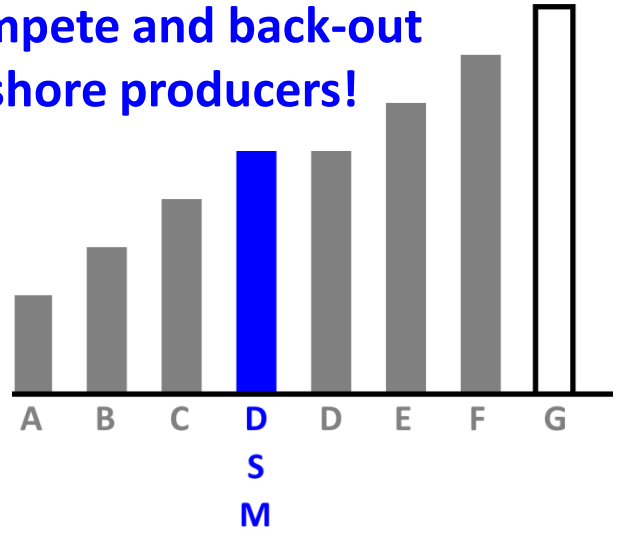
Mining Financials 1.01 still works for DSM:

- If DSM can supply cheaper minerals ($/t) than existing suppliers it will capture market share…

**Onshore before DSM view is WRONG!**



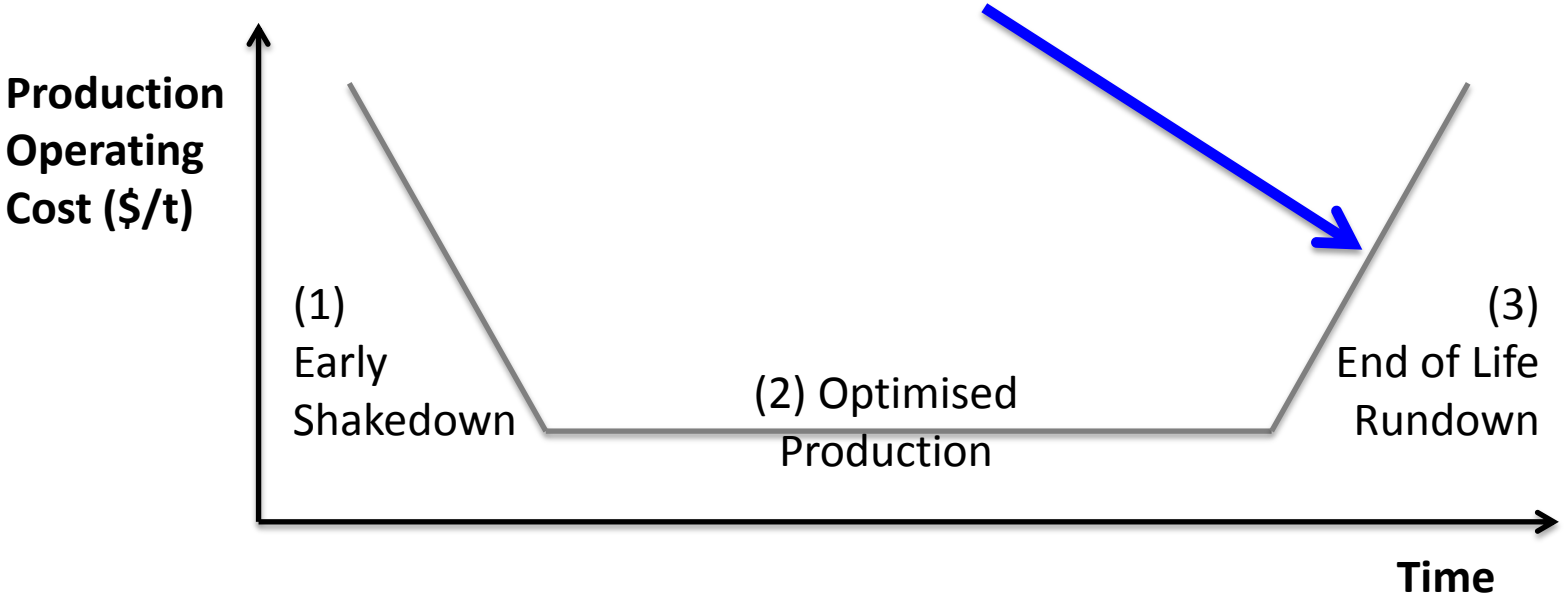

**DSM has the potential to compete and back-out onshore producers!**



# Onshore Mining Cost Fundamentals

Every natural resource project is subject to the “Bathtub Effect”!

**With each passing year DSM is competing against more onshore mines in Stage (3)**



# Conclusions

- Don’t be afraid of Pre-Mining Project Values
- Quantify DSM uncertainty:
  - Embrace data ranges at every opportunity
  - Quantify reward (NPV$)
  - Quantify risk (PoS% & EMV$)
- Understand Mining Market Fundamentals:
  - Mining Financials 1.01 (lowest $/t wins)
  - The Bathtub Effect is an opportunity for DSM!

# P.S. – Be Confident of DSM!!

- 20 years in O&G/LNG, I choose to stay in DSM, why?
  - DSM is inevitable
  - In 10 years, NO “showstoppers” to sustainable DSM & it is right to keep it under the microscope
  - I want to get DSM right for my kids & yours
  - So now I’m a geologist working with engineers to get the solutions we will need for DSM
- Biggest Challenge to DSM = Education/Communication!
  - DSM will be better managed than onshore mines
  - Make informed decisions, not emotional ones.

# Questions